

WHAT IS CLAIMED IS:

1. A primary battery, comprising:
a cathode comprising an oxide containing an alkali metal and pentavalent bismuth, the alkali metal being lithium or potassium;
an anode;
a separator between the cathode and the anode; and
an alkaline electrolyte.
2. The battery of claim 1, wherein the oxide is LiBiO_3 , Li_3BiO_4 , Li_5BiO_5 , Li_7BiO_6 , $\text{Li}_4\text{Bi}_2\text{O}_7$, $\text{Li}_5\text{Bi}_3\text{O}_{10}$ or KBiO_3 .
3. The battery of claim 1, wherein the oxide comprises an electrically conductive portion.
4. The battery of claim 3, wherein the electrically conductive portion is an electrically conductive surface coating comprising carbon or a metal oxide.
5. The battery of claim 4, wherein the electrically conductive surface coating comprises a material selected from the group consisting of graphite, carbon black, acetylene black, cobalt oxide, cobalt oxyhydroxide, silver oxide, silver nickel oxide, nickel oxyhydroxide, and indium oxide.
6. The battery of claim 1, wherein the anode comprises zinc.
7. The battery of claim 1, wherein the electrolyte comprises lithium hydroxide, sodium hydroxide, or potassium hydroxide.
8. The battery of claim 1, wherein the separator is capable of preventing soluble bismuth species from diffusing from the cathode to the anode.

9. The battery of claim 1, wherein the separator is capable of trapping soluble bismuth species.
10. A primary battery, comprising:
 - a cathode comprising an oxide containing an alkaline earth metal and pentavalent bismuth;
 - an anode;
 - a separator between the cathode and the anode; and
 - an alkaline electrolyte.
11. The battery of claim 10, wherein the alkaline earth metal is selected from the group consisting of magnesium, calcium, strontium, and barium.
12. The battery of claim 10, wherein the oxide is MgBi_2O_6 , $\text{Sr}_2\text{Bi}_2\text{O}_7$, or $\text{Ba}_2\text{Bi}_2\text{O}_6$.
13. The battery of claim 10, wherein the oxide comprises an electrically conductive portion.
14. The battery of claim 13, wherein the electrically conductive portion is an electrically conductive surface coating comprising carbon or a metal oxide.
15. The battery of claim 14, wherein the electrically conductive surface coating comprises a material selected from the group consisting of graphite, carbon black, acetylene black, cobalt oxide, cobalt oxyhydroxide, silver oxide, silver nickel oxide, nickel oxyhydroxide, and indium oxide.
16. The battery of claim 10, wherein the oxide comprises cobalt oxyhydroxide and MgBi_2O_6 .
17. The battery of claim 10, wherein the anode comprises zinc.

18. The battery of claim 10, wherein the electrolyte comprises lithium hydroxide, sodium hydroxide, or potassium hydroxide.
19. The battery of claim 10, wherein the oxide further comprises an alkali metal.
20. The battery of claim 10, wherein the separator is capable of preventing soluble bismuth species from diffusing from the cathode to the anode.
21. The battery of claim 10, wherein the separator is capable of trapping soluble bismuth species.
22. A primary battery, comprising:
 - a cathode comprising an oxide containing a metal and pentavalent bismuth, the metal being a main group metal, a lanthanide or a transition metal other than silver;
 - an anode;
 - a separator between the cathode and the anode; and
 - an alkaline electrolyte.
23. The battery of claim 22, wherein the metal is selected from the group consisting of scandium, vanadium, manganese, iron, cobalt, nickel, copper, zinc, yttrium, zirconium, niobium, molybdenum, ruthenium, palladium, cadmium, tantalum, and tungsten.
24. The battery of claim 22, wherein the metal is selected from the group consisting of lanthanum, cerium, praseodymium, neodymium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, and ytterbium.
25. The battery of claim 22, wherein the metal is selected from the group consisting of indium, tin, antimony, and lead.
26. The battery of claim 22, wherein the oxide further comprises an alkali metal or an alkaline earth metal.

27. The battery of claim 22, wherein the oxide is ZnBi_2O_6 , $\text{Cu}_2\text{Bi}_2\text{O}_7$, CdBi_2O_6 , or $\text{Sr}_2\text{ScBiO}_6$.
28. The battery of claim 22, wherein the oxide comprises an electrically conductive portion.
29. The battery of claim 28, wherein the electrically conductive portion is an electrically conductive surface coating comprising carbon or a metal oxide.
30. The battery of claim 29, wherein the electrically conductive surface coating comprises a material selected from the group consisting of graphite, carbon black, acetylene black, cobalt oxide, cobalt oxyhydroxide, silver oxide, silver nickel oxide, nickel oxyhydroxide, and indium oxide.
31. The battery of claim 22, wherein the oxide comprises cobalt oxyhydroxide and ZnBi_2O_6 .
32. The battery of claim 22, wherein the anode comprises zinc.
33. The battery of claim 22, wherein the electrolyte comprises lithium hydroxide, sodium hydroxide, or potassium hydroxide.
34. The battery of claim 22, wherein the separator is capable of preventing soluble bismuth species from diffusing from the cathode to the anode.
35. The battery of claim 22, wherein the separator is capable of trapping soluble bismuth species.
36. A primary battery, comprising:
an alkaline electrolyte;

a cathode comprising an oxide containing pentavalent bismuth, the oxide having a solubility at room temperature less than about 75 ppm bismuth in the electrolyte;
an anode; and
a separator between the cathode and the anode.

37. The battery of claim 36, wherein the solubility at room temperature is less than about 50 ppm bismuth.

38. The battery of claim 36, wherein the oxide has a volumetric specific capacity of at least about 0.8 Ah/cm³.

39. The battery of claim 36, wherein the oxide has a volumetric specific capacity of at least about 1.5 Ah/cm³.

40. The battery of claim 36, having an average running voltage of at least about 1.4 V.

41. The battery of claim 36, having an average running voltage is at least about 1.6 V.